(No Model.)

J. B. STRUBLE.

SIGNALING FOR ELECTRIC RAILWAYS.

No. 590,599. Patented Sept. 28, 1897.

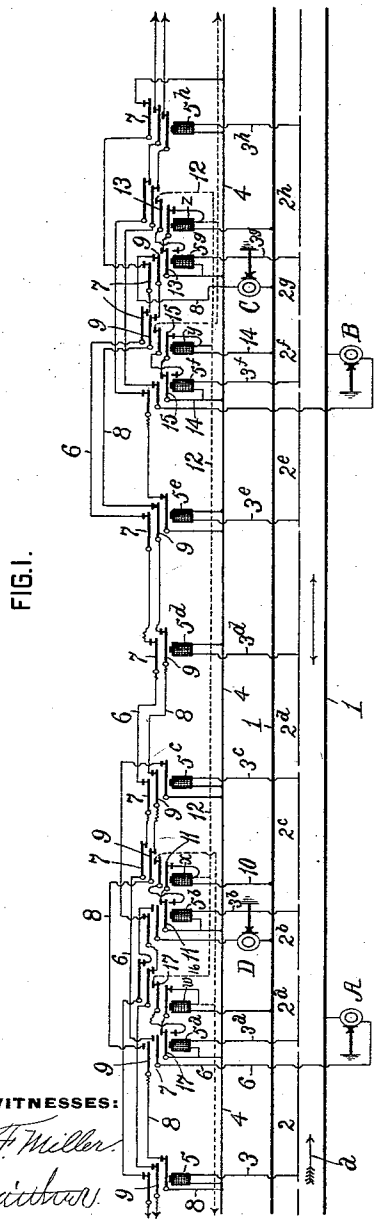

FIG. 1.

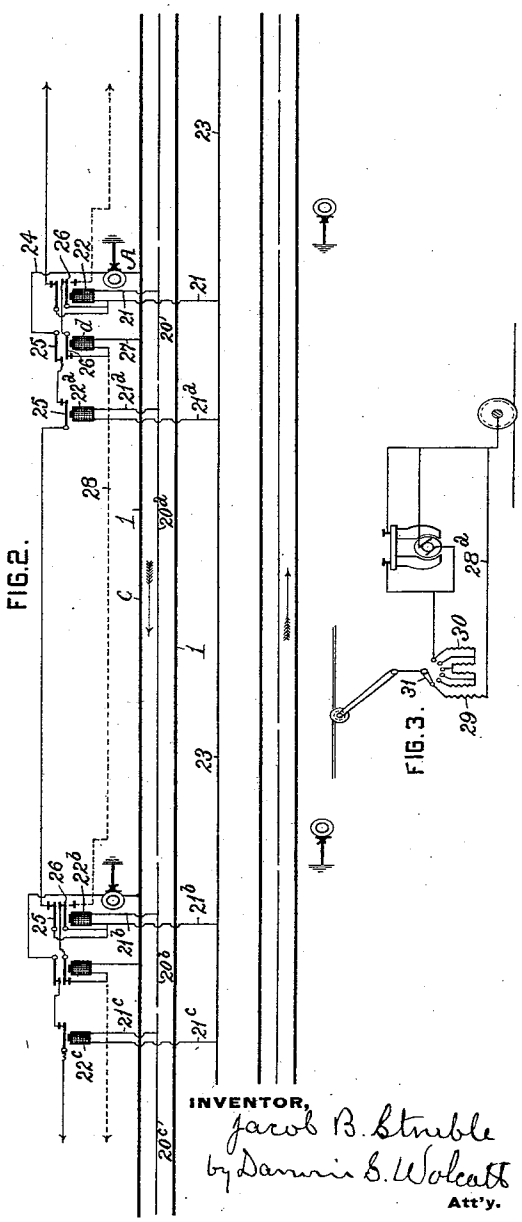

FIG. 2.

FIG. 3.

WITNESSES:

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SIGNALING FOR ELECTRIC RAILWAYS.

SPECIFICATION forming part of Letters Patent No. 590,599, dated September 28, 1897.

Application filed January 2, 1897. Serial No. 617,727. (No model.)

To all whom it may concern:

Be it known that I, JACOB B. STRUBLE, a citizen of the United States, residing at Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have invented or discovered certain new and useful Improvements in Signaling for Electric Railways, of which improvements the following is a specification.

The invention described herein relates to certain improvements in signaling electrically-operated railways, and has for its object the operation and control of the signals by the current employed in propelling the cars, operating through suitable relays and make-and-break mechanisms.

In general terms the invention consists in the construction and combination substantially as hereinafter more fully described and claimed.

In the accompanying drawings, forming a part of this specification, Figure 1 is a diagrammatic view showing the application of my improvements to a single-track road. Fig. 2 is a similar view, the improvements being applied to a double-track road; and Fig. 3 is a detail view showing the shunt-circuit around the rheostat and car-motor.

In the practice of my invention the rails 1 are electrically connected or bonded together in the usual or any suitable manner and form the return-conductor for the current, as is customary. The trolley-wire is divided into a number of sections 2 2^a 2^b, &c., each section being connected by wires 3 3^a 3^b, &c., to the continuous main feed-wire 4, which is supported in any suitable manner in convenient proximity to the trolley-wire. A series of magnets 5 5^a 5^b, &c., are included in and form a part of the circuits of which the branch feed-wires 3 3^a, &c., form a part.

In single-track roads signals A and D are arranged on opposite sides of the track at or near the ends of adjacent blocks, which may be of any suitable length, and signals B and C are similarly arranged at the opposite end of the block. These signals are operated by any suitable form or construction of electrically controlled or actuated mechanism. The controlling or actuating circuit of signal A consists of wire 6 and armatures 7 of magnets 5^a, x, 5^c, 5^d, 5^e, y, 5^g, and 5^h, the ends of such circuit being connected, respectively, to the rails 1 and main feed-wire 4. The circuit of signal C, starting from the rails 1, consists of wire 8 and armatures 9 of magnets 5^g, y, 5^e, 5^d, 5^c, x, 5^a, and 5, and main feed-wire.

The magnets x and y are double wound or formed by two independent coils. One of the coils of magnet x is included in a circuit starting from the rail and formed by wire 10 and armatures 11 of magnets x and 5^b and main feed-wire 4. The circuit of the other coil of magnet x consists, starting from one of the rails, of wire 10, one coil of magnet x, wires 12, and armatures 13 of magnets z and 5^g, and main feed-wire. One coil of magnet y is included in circuit starting from the rails 1 and formed by wire 14, armatures 15 of magnets y and 5^f, and main feed-wire, and the other coil of this magnet is included in a circuit starting from rails 1 and consisting of wires 14, 12, and 16, armatures 17 of magnets w and 5^a, and main feed-wire.

As soon as the trolley of a car moving in the direction of arrow a comes in contact with section 2 of the trolley-wire the circuit from the feed-wire to the rails through magnet 5 will be completed. The energizing of this magnet will shift its armature 9 and break the circuit of signal C, sending the latter to "danger" and thereby preventing the entrance of a car moving in the direction of arrow b into the opposite end of the block. The signal is maintained in danger position by a similar shifting of the armatures 9 of magnets 5^a, 5^c, 5^d, 5^e, and 5^g, due to their being energized when the trolley of the car comes in contact with the corresponding sections of the trolley-wire.

As the trolley comes in contact with section 2^b of the trolley-wire the circuit of locking-magnet x will be broken by the movement of the armature 11. The deënergizing of magnet x permits its armature 9 to so move as to form a break in the circuit of signal C, and as the circuit of one of the coils of magnet x is formed in part by its armature 11 it is evident that until the other coil of magnet is energized this break in the signal-circuit will remain, even if the other breaks are closed by the trolley leaving the trolley-wire. The break in circuit of signal C controlled by magnet x will remain open until the trol-

ley comes into contact with trolley-section 3^g, thereby energizing magnet 5^g. The movement of armature 13, due to energizing magnet 5^g, will close the releasing-circuit at that point and also break the circuit of magnet z, so that its armature will close another break in the releasing-circuit formed by wire 12 and passing through one coil of magnet x, thereby reënergizing the latter and causing its armature to so move as to close the final break in the circuit of signal C, restoring the latter to clear position.

In addition to effecting the release of signal C the magnets 5^g and z serve to hold the succeeding signal at "danger," the constructions and circuit-connections magnet z being similar to those of the magnet x.

The rear of the car is protected by signal A, which is set to "danger" on the break in its circuit, caused by the movement of armature 7 when magnet 5^a is energized by the contact of the trolley with section 2^a of the trolley-wire. The circuit of signal A is successively broken by the movements of armatures 7 of magnets 5^c, 5^d, 5^e, 5^g, and 5^h, due to the successive energizing of such magnets while the car is passing along the block. The signal-circuit is also broken, the movements of the armatures 7 of magnets x y, due to the demagnetization of said magnets by the rupture of their circuits when magnets 5^b and 5^f are energized. The deënergizing of lock-magnet x holds the circuit of signal A open, even if the trolley leaves its wire, until the release-circuit is closed by deënergizing magnet z by the energizing of magnet 5^g in the manner heretofore described.

In applying my improvement to double-track roads the trolley-wire is divided into sections 20 20^a 20^b, &c., each section being connected by branch wires 21 21^a, &c., and magnets 22 22^a 22^b, &c., with the main feed-wire 23. The circuit for signal A is formed by wire 24 and armatures 25 of magnets d, 22^a, and 22^b, and is connected at its ends to the rails 1 and main feed-wire 23, respectively. The magnet d forms part of two circuits, one of which is normally closed and is formed, starting from main feed-wire by wire 21, armatures 26 of magnets 22 and d, wire 27, to rail 1, while the other or normally open circuit starts from rail 1 and consists of wire 27, coil of magnet d, wire 28, armature 26 of magnet 22^b, and wire 21^b, to main feed-wire.

When the trolley of a car moving in the direction of arrow c comes in contact with section 20 of the trolley-wire, the circuit through magnet 22 will be completed and the energizing of the magnet will be followed by such a movement of its armature 26 as will break the normally-closed circuit of magnet d, thereby permitting such a movement of its armature 25 as will break the circuit of signal A, which will then go to "danger." The signal is maintained in this position while the car is passing along the block by the break in its circuit, effected by the described movement of armature 25 of magnet d, as the demagnetization of the magnet permits armature 26 to so move as to form a second break in its normally-closed circuit, and as this forms a part of its circuit, the magnet cannot be again energized except by the closing of the release or normally open circuit. The closing of this release-circuit is effected by the contact of the trolley with the section 20^b of the trolley-wire, thereby energizing magnet 22^b and the consequent movement of its armature 26 against its front contact. The energizing of magnet d by the closure of the release-circuit so shifts its armatures 25 and 26 as to close both the signal-circuit and the normally-closed circuit of magnet d.

In order to insure the maintenance of the signal at "danger" or its return to such position in case the release-circuit is closed after the trolley has passed off section 20 of the trolley-wire, one or more magnets 22^b are included in the circuit or circuits of the branch or branches from the main feed-wire to the section or sections 20^a of the trolley, said section or sections extending nearly the entire length of the block. The armature of this magnet is so arranged in the signal-circuit that its movement consequent upon the energizing of 22^b will break the signal-circuit, thereby holding or returning the signal to danger position.

It is evident that the signal-circuit can be held open either by the lock-magnets or by the intermediate or relay magnets. Either system can be employed alone, but it is preferred to use both, as each adds safeguards to the proper operation of the signals. As the proper operation of the intermediate or relay magnets depends upon the passage of the current, provision is made for maintenance of the flow of the current when the switch is opened to cut the current from the car-motors to stop the car or while it is running downgrade. This is effected by arranging a shunt-circuit 28^a, containing a high-resistance coil 29, around the rheostat 30 and motor, as shown in Fig. 3. This shunt-circuit is arranged so as to be closed just as the current is cut off from the motor by the switch 31.

I claim herein as my invention—

1. In a system of signaling for electric railways, the combination of the main feed-wire, a return-conductor, a trolley-wire extending along the block to be protected, one or more branch or feed wires forming a permanent connection between the main feed-wire and the trolley-wire, a magnet forming a portion of the branch or feed wire, a signal and a circuit controlling said signal and including as a part thereof the armature of said magnet, substantially as set forth.

2. In a system of signaling for electric railways, the combination of a main feed-wire, a return-conductor, a trolley-wire extending along the block to be protected and divided into two or more sections, each section hav-

ing a permanent connection to the main feed-wire, magnets forming portions of the connections between the feed and trolley wires, a signal and a circuit controlling said signal, and including as parts thereof the armatures of said magnets, substantially as set forth.

3. In a system of signaling for electric railways, the combination of a main feed-wire, a return-conductor, a trolley-wire extending along the block to be protected and divided into two or more sections, each section being connected to the main feed-wire, a signal, a circuit controlling the signal, controlling-magnet forming parts of the connections between the feed-wire and trolley-wire, locking-magnets having a normally-closed and a normally open circuit, the armatures of the locking and controlling magnets forming parts of the normally-closed circuit, and a circuit-breaker included in the signal-circuit and controlled by the locking-magnet, substantially as set forth.

4. In a system of signaling for electric railways, the combination of a main feed-wire, a return-conductor, a trolley-wire extending along the track and divided into two or more sections, each section being connected to the main feed-wire, a signal, a circuit controlling the signal, a make-and-break mechanism in the signal-circuit, a controlling-magnet forming part of the connection between the feed-wire and the trolley-wire section at the entrance of the block and adapted to open the make-and-break mechanism, and a controlling-magnet forming part of the connection between the feed-wire and the trolley-wire section at the exit end of the block and adapted to close the make-and-break mechanism, substantially as set forth.

5. In a system of signaling for electric railways, the combination of a main feed-wire, a return-conductor, a trolley-wire extending along the track and divided into a series of two or more sections, two or more branch or feed wires having permanent connections to the main feed-wire and the trolley-wire sections, magnets forming parts of the branch or feed wires, a signal, a circuit controlling said signal and make-and-break mechanisms included in the signal-circuit and adapted to be operated by the magnets, substantially as set forth.

6. In a system of signaling for electric railways, the combination of a main feed-wire, a return-conductor, a trolley extending along the track, a branch or feed wire forming a permanent connection between the main feed-wire and the trolley-wire, a magnet forming part of the branch wire, a signal, a circuit controlling said signal, a make-and-break mechanism included in the signal-circuit and adapted to be operated by the magnet, a motor, a shunt-circuit around the motor and a switch for turning the current from the motor to the shunt-circuit, substantially as set forth.

In testimony whereof I have hereunto set my hand.

JACOB B. STRUBLE.

Witnesses:
DARWIN S. WOLCOTT,
F. E. GAITHER.